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[Czechoslovakian Patent No. 263 075]

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METHOD FOR PRODUCING BULKY BONDED FABRICS

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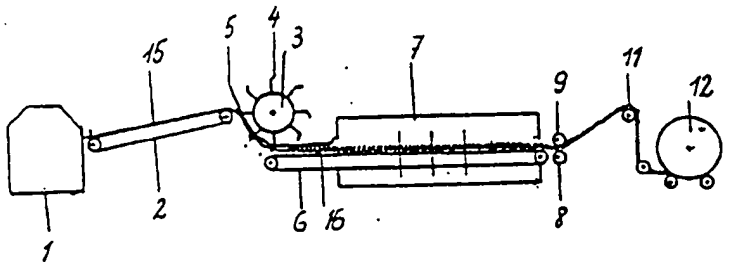
[Abstract]

The invention relates to the field of fabric manufacturing, specifically to the manufacture of fabrics from web or fibrous web with a portion of the thermoplastic fibers bonded by heat. The web or fibrous web is shaped prior to entering the heating zone by using of rotating or vibrating elements that reorient a portion of the fibers into what is essentially a normal position relative to the direction of fabric movement.



The invention relates to the manufacture of high-bulk bonded fabrics from a web or fibrous web with a portion of thermoplastic fibers being bonded by heat.

Apparel and industrial manufacturing demand ever more efficient materials with ever-improving insulating properties against heat and sound combined with good mechanical properties. The most efficient process for manufacturing such high-bulk materials is currently based on bonding a fibrous web with a portion of a thermoplastic component, most commonly adhesive fibers, either by hot calendering or by heating with hot air. Hot-air heating is more convenient for manufacturing high-bulk fabrics. It has the disadvantage, however, that if the fabric does not contain a high percentage of adhesive, good strength is not obtained, and more importantly, the product tears easily and its thickness shrinks in use, thereby significantly reducing its thermal insulating ability.

Methods, and the production lines corresponding to them, are known which partially eliminate this disadvantage.

According to DOS No. 3,123,912, a web formed primarily of thermoplastic fibers is preheated on one surface and fed through a feed slot between two rollers heated to different temperatures,

with the surface of the cooler roller being in contact with the preheated surface and the cooler surface of the web being heated to the melting point.

U.S. Patent No. 4,273,635 claims a process and equipment for manufacturing bulk fabrics from a mixture of fibers containing adhesive fibers by passing the web between rollers that create an insulating gap, with one roller serving simultaneously as an electrode connected to a high-frequency generator; the other roller is covered with a dielectric material with a smooth surface. After the web is compressed by passing through the rollers, glow discharges between the electrodes cause the adhesive fibers to cohere.

An invention claimed by British Patent No. 2,127,864 is supposed to result in a more high-bulk web with a change in the orientation of the fibers. This is achieved by placing the web on a very coarse mesh and passing a fast flow of air over it, melting the adhesive and pressing the web into the mesh openings. The invention in French Patent No. 2,083,529 defines the shape of the mesh and the location of impervious surfaces.

European Patent No. 80,144 describes a method for manufacturing point-bonded goods by melting the adhesive component of the web with heat and pressure, and pressing it by randomly positioned surfaces of the pressing roller.

Despite great efforts, these approaches have not proved workable for functional and, mainly, economic reasons, and therefore the most common method for manufacturing high-bulk bonded fabrics continues to be the production of cross-laid web on a carding machine or on a pneumatic web-maker, punching it on a needle loom to improve its strength and change the orientation of some of the fibers prior to the heating step. Cross-laying and

needle punching is an expensive way to achieve a partial change in fiber orientation in the fibrous layer. A needle loom in a production line consisting of a carding machine, web formation equipment, a needle loom and a hot air bonding chamber frequently accounts for a third of the capital costs, and during production the needle loom is the most frequent cause of problems in a smooth operation. Web formation equipment and the associated needle loom currently take up approximately half of the floor space required by the entire production line.

These disadvantages are eliminated by a method for manufacturing high-bulk bonded fabrics from a web or fibrous web containing thermoplastic fibers bonded by heat according to the invention. The invention essentially consists of forming the web or fibrous web prior to its entry into the heating zone by using rotating or vibrating elements to reorient a portion of the fibers to an essentially normal position relative to the direction of fabric movement. According to the preferred embodiment, formation is accomplished by a system of pins positioned along the circumference of a rotating roller, from which the compacted material is removed by the bars of a grate which passes through the rows of pins. Further, it is possible to form the fibers using a smooth vibrating strip or a strip provided with pins. In another case, it is possible to use a system of flexible strips that are attached to the circumference of a rotating roller, and to remove the web with a scraping board that ensures that the web is of the proper thickness. Lastly, the web may be formed by a system of oscillating pins, like the take-off comb of a carding machine or a row of punch needles, vibrating directly above the conveyer belt containing the web, and penetrating to a maximum depth of two-thirds, by orienting

either the web itself or the starting fibrous web into vertical folds.

The manufacturing method according to the invention has a number of advantages. It saves about half the floor area required for the production line and the loading end of the web formation system, consisting of crosslaying equipment and the needle loom. The web is formed by folding the fibrous web, with individual folds being oriented essentially normal to its plane so that the resulting structure is substantially more resistant to compression. Formation of the fibrous web surface by punch needles located on either the vibrating comb or a light needle board both evens out the surface and palletizes the sections of base and adhering fibers, thereby improving subsequent bonding, making the surface stronger and improving adherence of the individual surface fibers. This method of forming the surface of a fibrous web prior to bonding can also advantageous for improving the properties of bonded fabrics manufactured from high-bulk webs made by cross-laying the fibrous web.

The method according to the invention is further described by several examples and the attached drawings, where Figure 1 illustrates the system for forming the fibrous web and bonding, Figure 2 shows the formation of the web by a roller with flexible strips, Figure 3 shows the reorientation of the fibers in the fibrous web by a system of needles, Figure 4 shows the reorientation of fibers in the fibrous web by a system of pins on a comb, and Figure 5 shows the folding of a fibrous web into a web by an oscillating system of pins.

As is evident from Figure 1, the equipment according to the invention comprises a web formation machine (1), a conveyer belt (2), fibrous web (15), and a working roller (3) with pegs (4) and

a system of guide wires (5) that in combination with a delivery lattice (6) form the space for creating the fibrous web (16). The pins (4) move between the guide wires (5), which strip the fibrous web (15) off them in the zone where the fibrous layer is being formed. The resulting fibrous layer (16) enters the hot air bonding chamber (7), where it is consolidated. In the area above the resulting fibrous layer (16) a vibrating comb (10) or a needle board, which is not shown, may be located to modify the surface of the layer (16). A pair of forming rollers (8, 9) is positioned after the hot air chamber (7) or the hot air drum device as well as the usual adjustment (11) and roll-up equipment (12).

Example 1

On equipment as illustrated in Figure 1, the conveyer belt (2) transports the fibrous web (15) from the carding machine (1) at a speed of 12 m/min. The weight (g/m^2) of the fibrous web is 20 g/m^2 and the fibrous web consists of 80 wt% basic polyester fibers (44 dtex, 57 mm) and 20 wt% bonded polypropylene fibers (1.7 dtex, 60 mm). The fibrous web is formed by the pins (4) on a roller rotating such that the input speed of the working parts of the pins (4) corresponds to the rate of movement of the fibrous web (15). In the space between the guide wires (5) and the take-off belt (6) a fibrous layer is formed with essentially vertical folds. The take-off speed of the belt (6) is 3 m/min. The resulting fibrous layer enters the hot-air bonding chamber (7), where it is bonded by hot air at 170°C introduced perpendicularly. After leaving the bonding chamber (7) the layer is formed by a pair of smooth metals rollers (8, 9) forming a

slot 7 mm thick. The resulting layer has a weight of 80 g/m^2 and a thickness of 7 mm. It has excellent resistance to compression and heat insulating properties.

Example 2

Figure 2 illustrates the set up and procedure when fibrous web (15) with a weight of 5 g/m^2 and a composition as in Example 1 is fed from the carding machine at a speed of 30 m/min to the forming rollers (20) with flexible strips (21) layering the individual folds of the fibrous web onto the perforated drum (22) of the hot air device (23) as it rotates at a circumferential speed of 5 m/min. After bonding at 175°C, a high-bulk fabric with a weight of 30 g/m^2 and very good heat insulating properties is obtained.

Example 3

A fibrous layer (30), see Figure 3, with a weight of 150 g/m^2 and a composition as in Example 1, prepared by cross laying a fibrous web, is worked by a system of needle punches (31) installed on a vibrating board (32) in such a way that the ends of the needle punches (31) penetrate only halfway into the layer (30). The board moves with a frequency of 600 min^{-1} and the number of punctures is 70 cm^{-1}. The layer is then consolidated by bonding in hot air chamber (33).

Example 4

As can be seen from Figure 4, the fibrous layer (40), as in Example 3, is worked by a system of pins installed on comb (42) at a vibration frequency of 2,500 min^{-1}. The pins (41) penetrate a third of the thickness of the fibrous layer (40).

Example 5

The fibrous web (50), as in Example 1, see Figure 5, is led from the carding machine (51), formed by a system of pins (52) on an oscillating frame (53) into a folded web (54) on conveyer belt (55), which is transported to the bonding chamber (56).

Claim

A method for manufacturing high-bulk bonded fabrics from a web or fibrous web with a portion of its thermoplastic fibers bonded by heat, characterized in that before entering the heating zone the fibrous web or the web is formed by rotating or vibrating elements to reorient a portion of the fibers into a normal position relative to the direction of fabric motion.

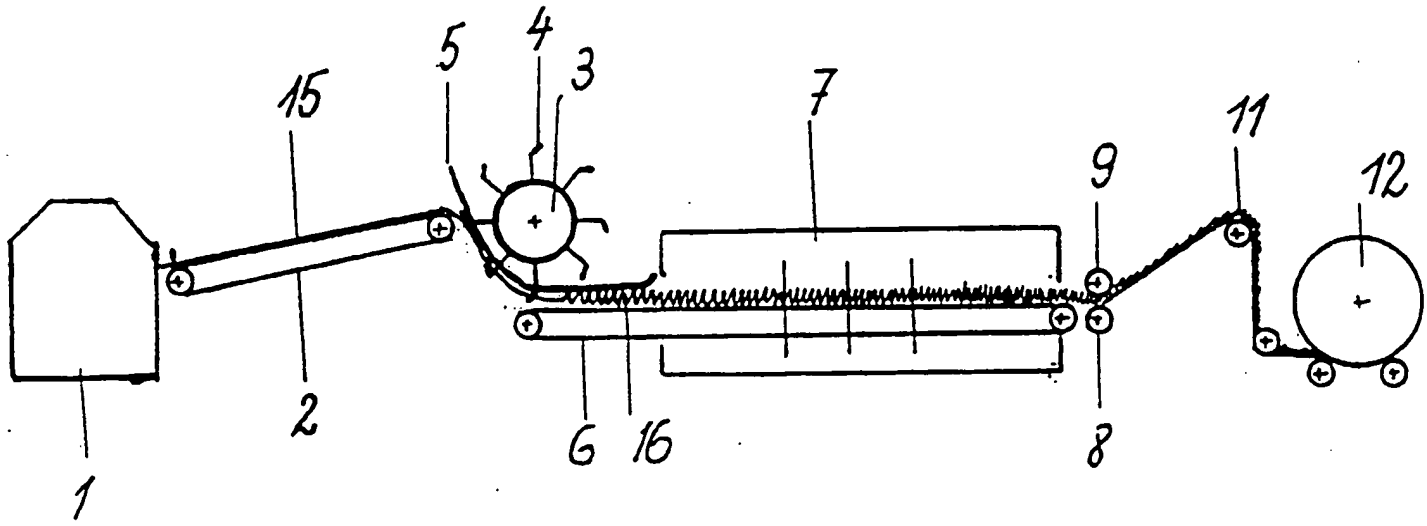


Figure 1

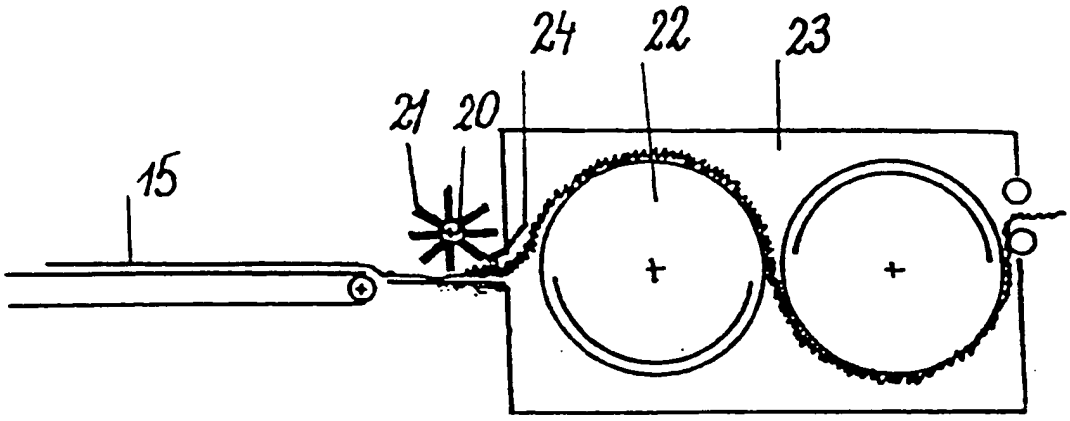


Figure 2

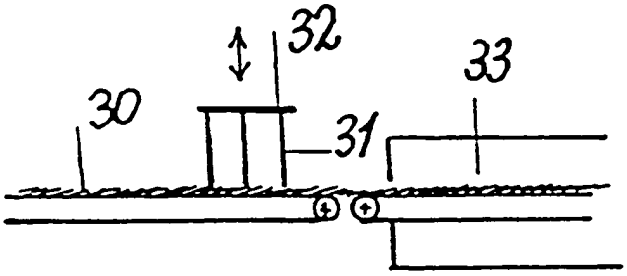


Figure 3

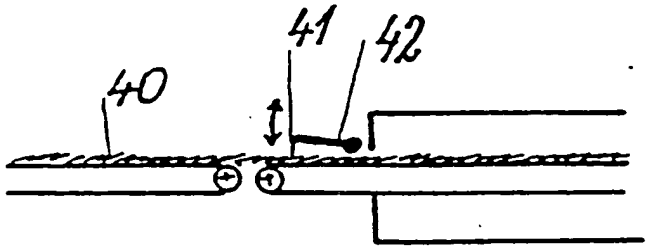


Figure 4

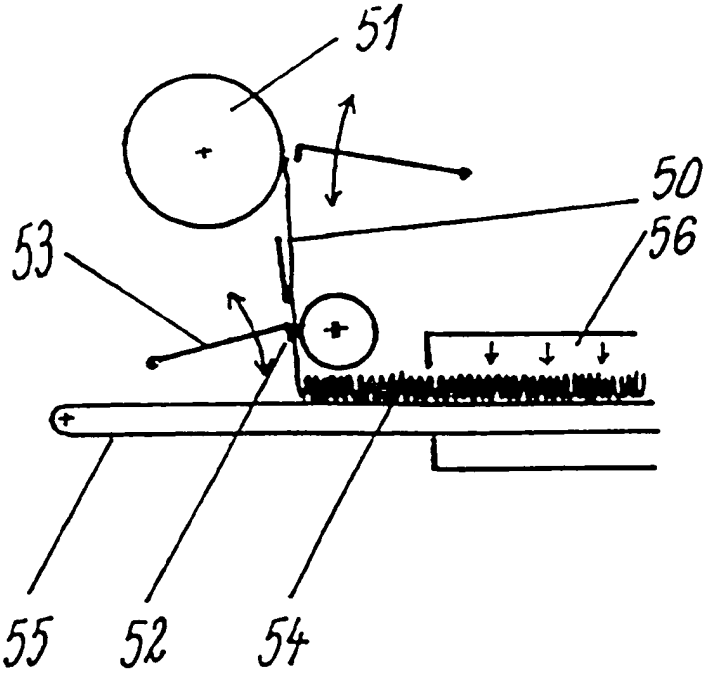


Figure 5